

UTJECAJ STUPNJA USITNJENOSTI ZRNA NA ODNOS FERMENTABILNOG I NEFERMANTABILNOG EKSTRAKTA U KOMINAMA DOBIVENIM OD JEČMNOG SLADA, NESLAĐENE PŠENICE I PŠENIČNOG SLADA

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Sažetak:

Ovaj rad je dio šireg istraživanja primjene “hard red winter” tipa pšenica, bilo kao neslađene sirovine bilo kao slada, iz domaćeg sortimenta ali i stranih sorti uvedenih u uzgoj, budući da su pokazale vrlo dobra pivarska svojstva. One osim navedenog imaju i brojne agrotehničke prednosti pri uzgoju. Karakterizira ih mješovita (mramorirana) tekstura endosperma zrna te iako pripadaju “hard” tipu tijekom procesuiranja pokazuju mnoge osobine svojstvene “soft” tipu pšenice. Ispitivan je utjecaj pripreme zrna za usipak (izmeljavanje) posljedično utječe na sve daljnje procese u proizvodnji piva. Cilj je bio ustanoviti utjecaj granulacije zrna na sastav usipka i njegovu fermentabilnost, tj. odnos fermentabilnog i nefermantabilnog ekstrakta u kominama. Za istraživanje je odabrane pšenična sorta koja je u prethodnim istraživanjima dala izvrsne rezultate i kao neslađena i kao slad, te su tijekom pripreme komina kombinirane sa ječmenim slalom (50:50). Proizvedene su komine/sladovine koje su analizirane standardnom pivarskom analitikom (EBC, MEBAK). Kod pšeničnih uzoraka rezultati pokazuju da bez obzira na polaznu razliku za ukupne proteine (TP) su koncentracije ukupnih topljivih proteina (TSP) i visokomolekulske proteinske frakcije (HMW N) slične, pšenični slad prati vrijednosti dobivene kod pšenice uz niži TP i slične vrijednosti za TSP, dok je za ječmeni slad unatoč značajno nižem TP koncentracija TSP bila značajno viša u odnosu na pšenicu i pšenični slad. Razlika koja se javlja u polaznim koncentracijama TP za pšenicu i pšenični slad je razlika u koncentraciji netopljivih proteinskih frakcija koja se tijekom ukomnjavanja eliminiraju. Nadalje, povećanjem finoće mljevenja zrna ($\emptyset$: 1 mm $\rightarrow$ 0,2 mm $\rightarrow$ $\emptyset$ 0.2 mm) tijekom ukomnjavanja dolazi do veoma značajnog porasta srednjemolekulske proteinske frakcije (MMW N) kod pšenice sa nižim i višim polaznim TP dok su za pšenične sladove karakteristične viša vrijednosti za visokomolekulske proteinske frakcije (HMW N) i slične vrijednosti za MMW N. Ovaj porast je kod pšenice sa nižom TP izraženiji, iako su polazne koncentracije TSP kod fine ($\emptyset$ =0.2mm) i najfinije meljave ($\emptyset$ =0.2 mm) bile slične. Kod ove pšenice, iako ima višu koncentraciju finog ekstrakta u komini u odnosu na pšenicu sa značajno višom polaznom koncentracijom proteina, također dolazi do značajnog pada fermentabilnosti kod najfinije granulacije usipka. Ječmeni slad je imao značajno više vrijednosti za HMW N i više vrijednosti za MMW N u odnosu na pšenice i pripadajuće pšenične sladove. Povećavanjem finoće meljave zrna dolazi do značajnog porasta finog ekstrakta u komini ali i značajnog porasta MMW N frakcija u njoj što posljedično dovodi ili do značajnog smanjenja fermentabilnosti ili do zadržavanja fermentabilnosti na približno istoj razini kod fine granulacije usipka ($\emptyset$ 0,2 mm) za pšenicu i nešto manje izraženo za pšenične sladove. Ovaj efekat je izraženiji za pšenicu sa nižim polaznim TP. MMW N proteinske frakcije pšenice i pšeničnih sladova pokazuju značajno veći afinitet prema vezanju sa



taninskom kiselinom u odnosu na ječmeni slad. Povećanje finoće meljave zrna nije uzrokovalo porast viskoznosti ni kod pšenica sa nižim ni sa višim udjelom TP.

Ključne reči: slad; pšenica, pošenični slad, stupanj uitnjavanja usipka; fermentabilnost komine

THE INFLUENCE OF MILLING GRANULATION ON THE PROPORTION OF FERMENTABLE AND NON-FERMENTABLE INGREDIENTS IN MASH OBTAINED FROM BARLEY MALT, UNMALTED WHEAT AND WHEAT MALT

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Summary:

This work is part of a wider research on the application of "hard red winter" type wheat, either as unmalted raw material or as malt, from the domestic assortment as well as foreign varieties introduced into cultivation, since they have shown very good brewing properties. In addition to the above, they also have numerous agrotechnical advantages during cultivation. They are characterized by a mixed (marbled) texture of the grain endosperm, and although they belong to the "hard" type, during processing they show many characteristics characteristic of the "soft" type of wheat. The influence of the preparation of grains for grinding (grinding) was examined, which consequently affects all further processes in the production of beer. The goal was to establish the influence of grain granulation on the composition of the mash and its fermentability, i.e. the ratio of fermentable and non-fermentable extract in wort. A wheat variety was chosen for the research, which in previous research gave excellent results both as unmalted and as malted, and during the preparation of the mash, they were combined with barley malt (50:50). The mashes/worts were produced and analyzed by standard brewing analysis (EBC, MEBAK). In the case of wheat samples, the results show that regardless of the initial difference for total proteins (TP), the concentrations of total soluble proteins (TSP) and high molecular weight protein fraction (HMW N) are similar, wheat malt follows the values obtained in wheat with lower TP and similar values for TSP, while for barley malt, despite a significantly lower TP, the concentration of TSP was significantly higher compared to wheat and wheat malt. The difference that occurs in the starting concentrations of TP for wheat and wheat malt is the difference in the concentration of insoluble protein fractions that are eliminated during milling. Furthermore, by increasing the grain fineness ($\emptyset$: 1 mm $\rightarrow$ 0.2 mm $\rightarrow$ $\emptyset$ 0.2 mm) during mashing, there is a very significant increase in the medium molecular protein fraction (MMW N) in wheats with lower and higher initial TP, while for wheat malts they are characteristically higher values for high molecular weight protein fractions (HMW N) and similar values for MMW N. This increase is more pronounced in wheat with lower TP, although the initial concentrations of TSP in fine ($\emptyset$ =0.2mm) and the finest ground meal ($\emptyset$ =0.2 mm) were similar. With this wheat, although it has a higher concentration of fine extract in the pomace compared to wheat with a significantly higher starting protein concentration, there is also a significant drop in fermentability at the finest granulation of the grain. Barley malt had significantly higher values for HMW N and higher values for MMW N compared to wheat and associated wheat malts. By increasing the fineness of ground grains, there is a significant increase in the fine extract in the mash, but also a significant increase in the MMW N fractions in it, which consequently



leads to either a significant decrease in fermentability or to keeping fermentability at approximately the same level in the case of fine granulation ($\emptyset$ 0.2 mm) for wheat and somewhat less pronounced for wheat malts. This effect is more pronounced for wheat with a lower initial TP. MMW N protein fractions of wheat and wheat malts show a significantly higher affinity for binding with tannic acid compared to barley malt. An increase in the fineness of the milled grain did not cause an increase in viscosity either in wheat with a lower or higher TP content.

Keywords: barley malt; wheat, wheat malt, grist milling degree; mash fermentability